

Cost-Risk Trade-off of Solar Radiation Management and Mitigation under Probabilistic Information on Climate Sensitivity

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In principle solar radiation management (SRM) offers an option to ameliorate anthropogenic temperature rise. However we cannot expect it to simultaneously compensate for anthropogenic changes in further climate variables in a perfect manner. Here, we ask to what extent a proponent of the 2°C-temperature target would apply SRM in conjunction with mitigation in view of global or regional disparities in precipitation changes. We apply cost-risk analysis (CRA), which is a decision analytic framework that makes a trade-off between the expected welfare-loss from climate policy costs and the climate risks from transgressing a climate target. Here, in both global-scale and 'Giorgi'-regional-scale analyses, we evaluate the optimal mixture of SRM and mitigation under probabilistic information about climate sensitivity. To do so, we generalize CRA for the sake of including not only temperature risk, but also globally aggregated and regionally disaggregated precipitation risks. Social welfare is maximized for the following three valuation scenarios: temperature-risk-only, precipitation-risk-only, and equally weighted both-risks.

For now, the Giorgi regions are treated by equal weight. We find that for regionally differentiated precipitation targets, the usage of SRM will be comparably more restricted. In the course of time, a cooling of up to 1.3°C can be attributed to SRM for the latter scenario and for a median climate sensitivity of 3°C (for a global target only, this number reduces by 0.5°C). Our results indicate that although SRM would almost completely substitute for mitigation in the globally aggregated analysis, it only saves 70% to 75% of the welfare-loss compared to a purely mitigation-based analysis (from economic costs and climate risks, approximately 4% in terms of BGE) when considering regional precipitation risks in precipitation-risk-only and both-risks scenarios.

It remains to be shown how the inclusion of further risks or different regional weights would change that picture.